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MILITARY POTENTIAL TEST OF THE SR-3 AND AN/ASN-50 FLIGHT REFERE--ETC(U)

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RDT&E PROJECT NO. ________

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USATECOM ~~PROJECT NO.~~ S 4-6-3260-01
USATECOM - 4-6-3261-01

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MILITARY POTENTIAL TEST

OF THE

SR-3 AND AN/ASN-50 FLIGHT REFERENCE SYSTEMS.

9

Final Report ~~of Test~~
26 Nov 65 - 30 Apr 66,

by

10

Major Cecil E. Wroten

11

25 May 1966

12 60p.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

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SUBJECT: Final Report of Test, "Military Potential Test of the SR-3 and AN/ASN-50 Flight Reference Systems," RDT&E Project No. ________________, USATECOM Project No.'s 4-6-3260-01 and 4-6-3261-01 (U)

If the error introduced by the water movement is not aligned with the longitudinal axis of the aircraft, the error will be shown as a compass error. To correct this error, the accuracy of all the compass systems tested has been recomputed with all over-water flights deleted. The results are:

	MA-1	AN/ASN-62	AN/ASN-50	SR-3
Average error from over-land flights (degrees).	0.825	0.480	0.295	0.504

NOTE: The AN/ASN-50 now meets the Military Characteristic requirement for a slaved accuracy of 0.4 degree.

b. This Board believes that there are two requirements for a self-contained navigation system in Army aircraft. The first requirement is for a highly accurate system to be used in sophisticated surveillance aircraft. This requirement places accuracy above all other considerations because the accuracy of the navigation system will have a direct bearing on the amount of intelligence obtained. The second requirement is for selected aircraft to support certain missions. These aircraft will live in a less strenuous environment, and accuracy can be sacrificed to some extent for other considerations. If this belief is correct, the AN/ASN-50 should be considered to have more military potential for the first requirement while the SR-3 has more potential for the second.

Raymond E. Johnson

1 Incl
as

RAYMOND E. JOHNSON
Colonel, Artillery
President

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Appendix V

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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

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25 MAY 1966

SUBJECT: Final Report of Test, "Military Potential Test of the SR-3 and AN/ASN-50 Flight Reference Systems," RDT&E Project No. ______________, USATECOM Project No.'s 4-6-3260-01 and 4-6-3261-01 (U)

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3. The following comments and opinions are submitted for consideration:

a. The Doppler position errors as shown in part D, appendix I, section 3, of this report and in figure 10 of the service test report of the AN/ASN-62( ) Gyromagnetic Compass Set (USATECOM Project No. 4-5-3015-03) are misleading. This situation results from using data obtained from over-water flights in the computation of total compass errors. This method was in accordance with the plans of test and has merit in the evaluation of the Doppler sensor itself. However, this method results in errors caused by natural phenomena being indicated as compass angular errors. The Doppler sensor measures the velocity of the aircraft in which it is installed in relationship to the surface of the earth over which the aircraft is flown. When over a land mass, the Doppler output is correct within the design limitations of the equipment. When over water, the Doppler output accuracy depends on the stability of the water surface. Water movement (i.e., currents, tides, breaking waves, and wind spray) is detected and is vectorially added to the true velocity of the aircraft.

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RDT&E PROJECT NO. ______________

USATECOM PROJECT NO.'S 4-6-3260-01 AND 4-6-3261-01

"MILITARY POTENTIAL TEST OF THE SR-3 AND AN/ASN-50 FLIGHT REFERENCE SYSTEMS"

Final Report of Test

by

Major Cecil E. Wroten

25 May 1966

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

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ABSTRACT

The US Army Aviation Test Board conducted the military potential test of the SR-3 and AN/ASN-50 Flight Reference Systems at Fort Rucker, Alabama. The SR-3 and AN/ASN-50 were flight tested in an OV-1B for 258.5 hours and 120.0 hours during the period 26 November 1965 to 18 April 1966 and 1 February 1966 to 30 April 1966, respectively. The systems were compared with the requirements of the proposed Military Characteristics (MC's). Both systems met ten of the twenty-six essential requirements, failed to meet six, and only partially met one of the requirements. It will be determined during engineering tests whether the systems meet the remaining nine essential requirements. It was concluded that both systems have military potential and that correction of the shortcomings would enhance the potential of each. It was recommended that both systems be subjected to engineering/service tests and that the shortcomings be corrected if technically and economically feasible.

FOREWORD

This military potential test was directed by the Commanding General, US Army Test and Evaluation Command (USATECOM), in the following:

a. Letter, AMSTE-BG, Headquarters, USATECOM, 25 August 1965, subject: "Test Directive, Military Potential Test of the SR-3, Flight Reference System, USATECOM Project No. 4-6-3260-01."

b. Letter, AMSTE-BG, Headquarters, USATECOM, 10 January 1966, subject: "Test Directive, Military Potential Test of AN/ASN-50 Gyromagnetic Compass System, USATECOM Project No. 4-6-3261-01." (This directive stated that the details of tests of the AN/ASN-50 and the SR-3 could be submitted in a common report.)

The US Army Aviation Test Board (USAAVNTBD) was responsible for preparing the test plan, for conducting the test, and for preparing the test report.

TABLE OF CONTENTS

	Page No.
SECTION 1 - INTRODUCTION	1
1.1. Background	3
1.2. Description of Materiel	4
1.3. Test Objectives	7
1.4. Summary of Results	8
1.5. Conclusions	9
1.6. Recommendations	10
SECTION 2 - DETAILS OF TEST	11
2.1. Introduction	13
2.2. Physical Characteristics	13
2.3. Installation and Calibration	15
2.4. Operational Characteristics	18
2.5. Mission Suitability	20
2.6. Safety	20
2.7. Reliability	21
2.8. Maintenance and Support Requirements	22
SECTION 3 - APPENDICES	27
I. Test Data	29
II. Findings	43
III. Deficiencies and Shortcomings	53
IV. References	57
V. Distribution	61

SECTION 1 - INTRODUCTION

INTRODUCTION

1.1. BACKGROUND.

1.1.1. The current trend toward all-weather flight missions has substantially increased the electronic configuration of modern Army aircraft, resulting in an increased demand for accurate heading information. In October 1959, the Signal Corps Technical Committee (SCTC) recommended the development of a universal heading reference system to satisfy the requirement for a compass system usable in any geographic area and light enough for installation in Army aircraft requiring heading outputs from the compass system to the avionic equipment. The committee concluded that no basic research or advanced techniques would be needed, that the desired system could be designed using only commercial equipment available or under development. In 1963, Military Characteristics (MC's) for a universal heading reference system (reference 7, appendix IV, section 3) were prepared by the US Army Electronics Research and Development Laboratories (USAERDL).

1.1.2. To meet this need, a task was established to fabricate a heading reference system. This system, designated the AN/ASN-43(V), has various configurations depending upon the specific need for each aircraft; they are the "minimum," the "extended minimum," and the "maximum" systems. The "extended minimum" configuration has been tested (reference 8, appendix IV, section 3) and the system has been type classified.

1.1.2.1. The "maximum" configuration of the AN/ASN-43(V) was installed in two UH-19D Helicopters and used in support of the Army evaluation of commercial Doppler navigation systems. The results of this evaluation pointed out the need for improvements in the "maximum" configuration.

1.1.2.2. On the basis of these results, USAERDL decided to replace the AN/ASN-43(V) maximum system with a modified Air Force C-12 Compass System. This system was designated the AN/ASN-62. The AN/ASN-62 was service tested by the USAAVNTBD using the standard MA-1 Compass System as a control item. The report was submitted to USATECOM on 28 February 1966 (reference 16, appendix IV, section 3).

1.1.3. As an alternate solution, the SR-3 and AN/ASN-50 Flight Reference Systems (FRS's) were investigated under USATECOM subtasks in an effort to meet this increasing requirement for a lighter, more compact system for Army aircraft. The operational characteristics of these systems have been compared with those of the MA-1 Compass System (paragraph 1.4.3).

1.2. DESCRIPTION OF MATERIEL.

The SR-3 and AN/ASN-50 are designed to provide normal heading and attitude reference plus additional heading reference for a Doppler navigator.

1.2.1. SR-3 FRS.

The SR-3 (figure 1) is a miniature heading and attitude reference system. The system weighs approximately 18 pounds and consists of a flight reference platform, an induction compass transmitter, a controller, and a heading coupler. The SR-3 provides roll and pitch information without the need for a separate vertical gyro; however, this feature was not evaluated during this test.

1.2.1.1. The KD-9 Flight Reference Platform is a pendulously-erected, two-gyro, three-gimbal stable reference from which aircraft direction and attitudes are measured. Heading signals are supplied to the aircraft equipment through a repeater servo in the heading coupler, while attitude signals are supplied directly from the platform. Should multiple isolated outputs of pitch and roll be required, an attitude coupler can be added to the system.

1.2.1.2. The type KJ-4 Induction Compass Transmitter furnishes an electrical indication of aircraft heading with respect to the horizontal component of the earth's magnetic field. This signal is used as the heading reference during the slave mode of operation.

1.2.1.3. The type KE-65 Controller is a panel-mounted component which provides the cockpit controls necessary for operation of the system. These controls consist of a LATITUDE CORRECTION control, HEMISPHERE selector switch, MODE selector switch, and a fast synchronization switch. In addition, the control incorporates provisions for detection of significant faults in the power source and the heading transmission channel and for a two-control-station installation which would allow for taking command of the system at either station.

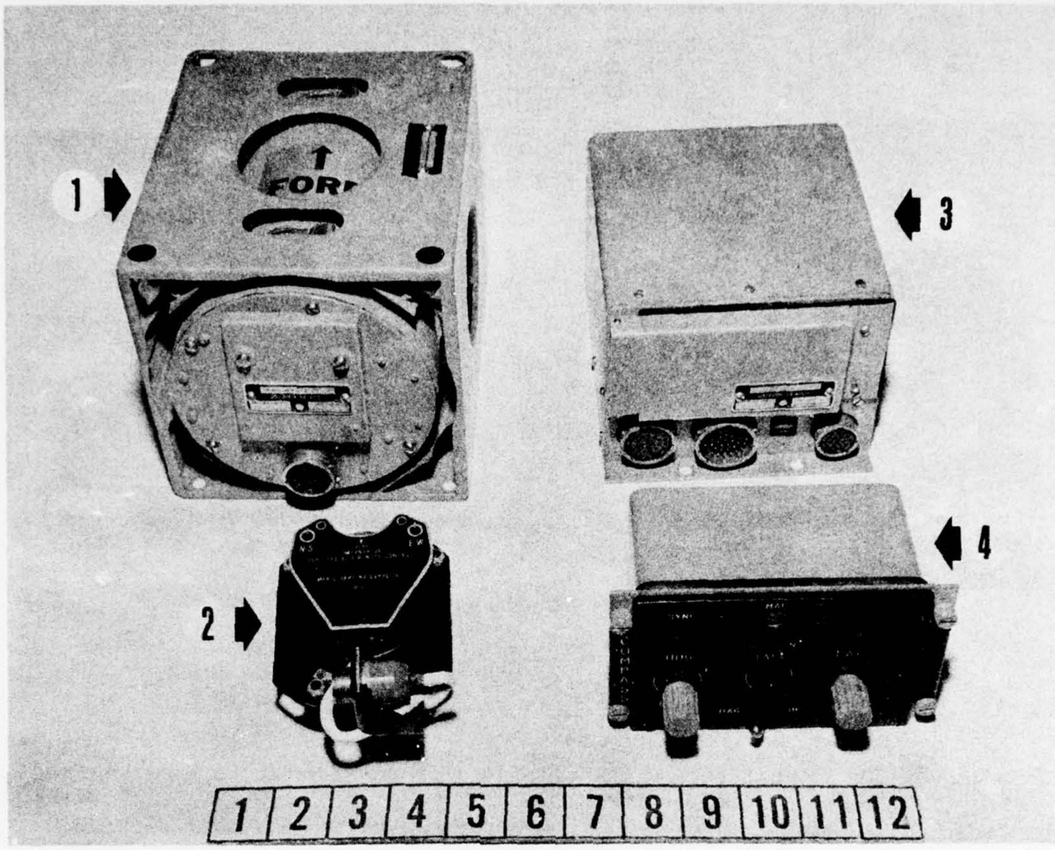


Figure 1. SR-3.
Arrow 1 - KD-9 Flight Reference Platform
Arrow 2 - KJ-4 Induction Compass Transmitter
Arrow 3 - KE-66 Heading Coupler
Arrow 4 - KE-65 Controller

1.2.1.4. The KE-66 Heading Coupler provides four compensated heading outputs. These outputs represent gyro-stabilized magnetic heading in the slave mode or free-gyro heading with the earth's rate correction in the directional gyro (DG) mode. In addition, the coupler contains servo modules, amplifier modules, and a power supply module.

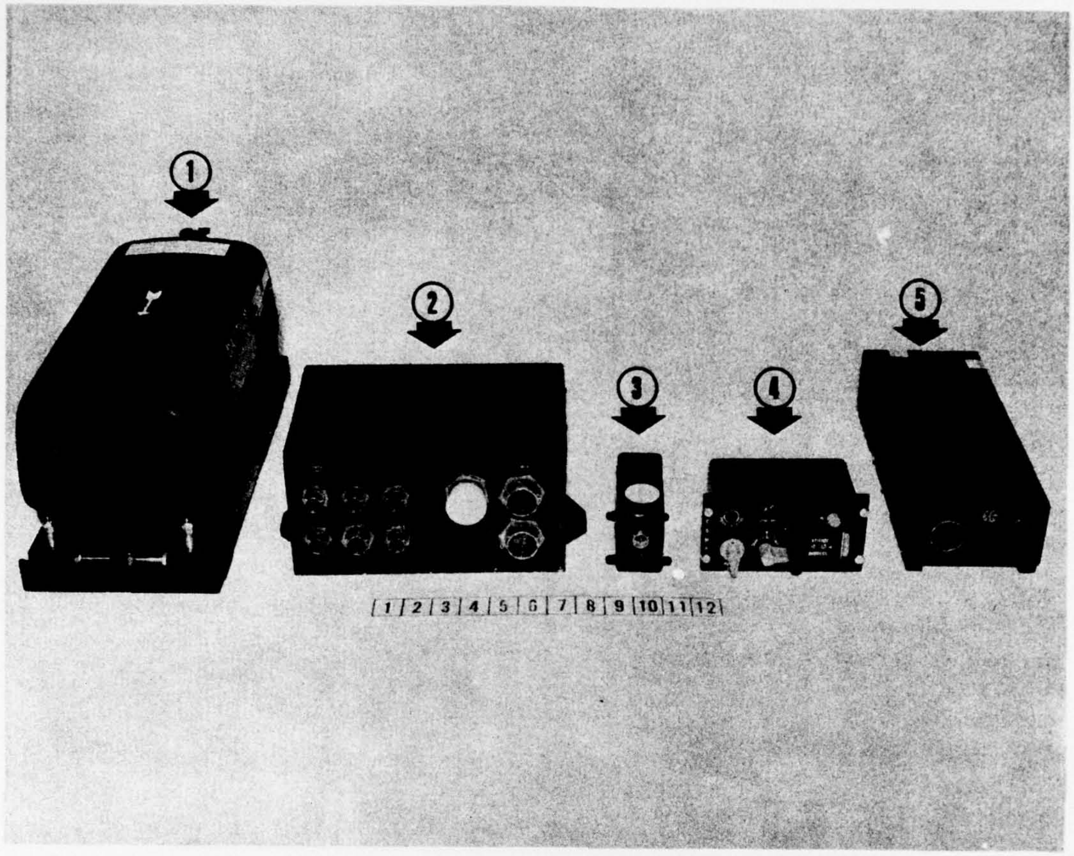


Figure 2. AN/ASN-50.
Arrow 1 - Displacement gyro
Arrow 2 - Compass adapter
Arrow 3 - Rate gyro
Arrow 4 - Compass controller
Arrow 5 - Amplifier power supply

1.2.2. AN/ASN-50 FRS.

The AN/ASN-50 (figure 2) is an all-attitude system which provides outputs in heading, pitch, and roll axes. The system weighs approximately 49 pounds and consists of a displacement gyro, amplifier power supply, rate gyro, compass adapter, and a compass controller. The pitch and roll outputs of the system were not evaluated during this test.

1.2.2.1. The displacement gyro contains a vertical gyro and a directional gyro, and it is the master reference for both attitude and heading information. The vertical gyro is mounted in a redundant roll gimbal which provides the attitude performance without gimbal lock or tumbling. The directional gyro is mounted in a servoed pitch gimbal.

1.2.2.2. The amplifier power supply contains the necessary power supplies, starting circuitry, and gyro gimbal stabilizing servo amplifier required for operation of the displacement gyro.

1.2.2.3. The rate gyro senses aircraft movement around the heading axis during turns and disconnects the vertical erection and DG slaving inputs.

1.2.2.4. The compass adapter receives DG azimuth information, synchronizes the azimuth signal to the magnetic heading signal of the magnetic detector, and furnishes multiple synchronized outputs of magnetic heading. It also contains an earth rate computer.

1.2.2.5. The compass controller is panel mounted and provides a means of manually controlling the heading subsystem mode selection, heading set, synchronization, and latitude set.

1.3. TEST OBJECTIVES.

1.3.1. Purpose.

To determine by operational tests the potential of the SR-3 and AN/ASN-50 FRS's for military use.

1.3.2. Objectives.

To determine:

a. Physical characteristics and power requirements.

b. Installation and calibration requirements.

c. Operational characteristics.

d. Mission suitability.

e. Safety characteristics.

f. Reliability characteristics.

g. Maintenance and support requirements.

1.4. SUMMARY OF RESULTS.

1.4.1. Physical Characteristics and Power Requirements.

1.4.1.1. The weight of the AN/ASN-50 exceeded that allowed by the MC's by 24.69 pounds. The system exceeded the volume limitations of the MC's by 0.232 cubic foot.

1.4.1.2. The weight of the SR-3 was less than that allowed by the MC's by 6.81 pounds. The volume of the SR-3 was 0.274 cubic foot less than that allowed by the MC's.

1.4.1.3. Maximum power requirements for each system were as follows:

AN/ASN-50 - Starting, 2.55 amperes.

SR-3 - Starting, 1.03 amperes.

1.4.2. Installation and Calibration Requirements.

The installation and calibration of the AN/ASN-50 and SR-3 in the OV-1B were time-consuming because of the complexity of the calibrating device.

1.4.3. Operational Characteristics.

1.4.3.1. The AN/ASN-50 and SR-3 were more accurate than the MA-1 Compass System.

1.4.3.2. When the AN/ASN-50 was operated in the free DG mode, the drift rates were satisfactory. The drift rates of the SR-3 and MA-1 systems were unsatisfactory.

1.4.3.3. Operation from pierced-steel planking (PSP) had no noticeable effect on the AN/ASN-50, SR-3, or MA-1 systems.

1.4.3.4. The outputs from the AN/ASN-50, SR-3, and MA-1 systems were adequate.

1.4.3.5. The time required for the AN/ASN-50, SR-3, and MA-1 systems to become operational after power application was within the allowable limits of the MC's.

1.4.4. Mission Suitability.

Both the AN/ASN-50 and SR-3 met ten of the twenty-six essential MC requirements and failed to meet six. The systems only partially met one of the requirements. It will be determined during engineering tests whether the systems meet the remaining nine essential requirements.

1.4.5. Safety Characteristics.

No unsafe features were noted in the AN/ASN-50 and SR-3.

1.4.6. Reliability.

The AN/ASN-50 experienced no failures in 120.0 hours of operation, whereas the SR-3 experienced two failures in 258.5 hours of operation.

1.4.7. Maintenance and Support Requirements.

1.4.7.1. The time and effort required to maintain the AN/ASN-50 and SR-3 were acceptable for the type of equipment.

1.4.7.2. Common tools were adequate for the maintenance of both the AN/ASN-50 and SR-3. Special test equipment was required for maintenance of both systems.

1.4.7.3. The SR-3 did not have readily-accessible test points for maintenance above the organizational category.

1.5. CONCLUSIONS.

1.5.1. Both the AN/ASN-50 and SR-3 have military potential.

1.5.2. Correction of the shortcomings listed in appendix III, section 3, would enhance the potential of the systems.

1.6. RECOMMENDATIONS.

It is recommended that:

1.6.1. Both the AN/ASN-50 and SR-3 systems be subjected to engineering/service tests.

1.6.2. The shortcomings listed in appendix III, section 3, be corrected if technically and economically feasible.

SECTION 2 - DETAILS OF TEST

DETAILS OF TEST

2.1. INTRODUCTION.

2.1.1. The USAAVNTBD flight tested the SR-3 and AN/ASN-50 Flight Reference Systems in an OV-1B Airplane at Fort Rucker, Alabama, during the period 26 November 1965 to 18 April 1966 and 1 February 1966 to 30 April 1966, respectively. The SR-3 was operated for 258.5 hours and the AN/ASN-50 for 120.0 hours.

2.1.2. The instrumentation used in the AN/ASN-62 Gyromagnetic Compass System Evaluation (reference 14, appendix IV, section 3) was used as far as possible for data collection.

2.1.3. The requirement to test the SR-3 and AN/ASN-50 in a CH-34 helicopter was deleted by USATECOM because the USAAVNTBD was required to turn in the only CH-34 available for the conduct of tests (reference 16, appendix IV, section 3).

2.2. PHYSICAL CHARACTERISTICS.

2.2.1. Objective.

To determine the physical characteristics and power requirements of the SR-3 and AN/ASN-50.

2.2.2. Method.

2.2.2.1. Each subcomponent of the SR-3 and AN/ASN-50 was weighed and measured. The total system weight was calculated by adding the individual component weights of each test item. The total system volume was calculated by adding the individual component volumes of each test item.

2.2.2.2. The equipment was operated in the OV-1B, and the alternating current (a.c.) and direct current (d.c.) power requirements were determined for each test item.

2.2.3. Results.

2.2.3.1. Size, Weight, and Volume.

2.2.3.1.1. SR-3.

Item	Width (in.)	Height (in.)	Length (in.)	Weight (lb.)	Volume (cu. in.)
Flight Reference Platform, KD-9	6.000	6.000	8.000	9.94	288.0
Induction Compass Transmitter, KJ-4	3.063	2.125	4.500	0.94	29.3
Compass Controller, KE-65	5.750	3.375	4.063	1.47	78.8
Heading Coupler, KE-66	5.563	4.313	7.000	5.84	167.9
TOTALS (See paragraph 2.3.3.2 for additional equipment installed.)				18.19	564.0 (0.326 cubic foot)

2.2.3.1.2. AN/ASN-50.

Item	Width (in.)	Height (in.)	Length (in.)	Weight (lb.)	Volume (cu. in.)
Displacement Gyro	7.000	7.375	15.063	26.50	777.6
Amplifier Power Supply	4.844	3.000	11.594	8.00	168.5
Compass Adapter	11.000	5.031	7.094	12.44	392.6
Compass Controller	5.750	3.031	4.063	1.56	70.8
Rate Gyro	2.406	2.625	4.531	1.19	28.6
TOTALS (See paragraph 2.3.3.2 for additional equipment installed.)				49.69	1438.1 (0.832 cubic foot)

2.2.3.2. Power Consumption.

2.2.3.2.1. SR-3.

a. Starting--115 volts a.c., three-phase, Wye-wound, 400-Hertz--1.03 amperes.

b. Running--115 volts a.c., three-phase, Wye-wound, 400-Hertz--0.83 ampere.

c. Lighting--28 volts d.c.--0.12 ampere.

2.2.3.2.2. AN/ASN-50.

a. Starting--115 volts a.c., three-phase, Wye-wound, 400-Hertz--2.55 amperes.

b. Running--115 volts a.c., three-phase, Wye-wound, 400-Hertz--1.22 amperes.

c. Lighting--28 volts d.c.--0.11 ampere.

2.2.4. Analysis.

Not applicable.

2.3. INSTALLATION AND CALIBRATION.

2.3.1. Objective.

To determine the installation and calibration requirements of the SR-3 and AN/ASN-50.

2.3.2. Method.

2.3.2.1. The test items were installed and calibrated in an OV-1B Airplane. Personnel required and man-hours expended for installation and calibration were recorded.

2.3.2.2. The test items were installed to operate from the existing aircraft electrical system, if possible. Additional equipment required was recorded.

2.3.2.3. The test items were operated in conjunction with other power-consuming devices installed in the OV-1B, and any mutual interference existing during calibration procedures was noted.

2.3.3. Results.

2.3.3.1. Installation and Calibration.

One Aviation Electronic Equipment Mechanic, MOS 31Q20, and two Aviation Electronic Equipment Repairmen, MOS 31Q30, installed and calibrated the SR-3 and the AN/ASN-50 in an OV-1B. The time required for installing and calibrating the systems was:

2.3.3.1.1. Installation.

	SR-3 (Man-Hours)	AN/ASN-50 (Man-Hours)
Initial planning	16	16
Preparation of wiring diagrams	16	Supplied by manufacturer
Cable fabrication	60	Supplied by manufacturer
Aircraft installation	80	84
Installation and operational check	16	16
Sheet-metal support	20	32
TOTAL	208	148*

2.3.3.1.2. Calibration.

Both systems in the OV-1B were calibrated using the MC-1 Magnetic Compass Calibrator. Sixteen man-hours were expended on each system to perform calibration procedures.

*Does not include man-hours required for preparation of wiring diagram and fabrication of cable.

2.3.3.2. Installation Requirements.

Neither the SR-3 nor the AN/ASN-50 could be installed in an airplane independent of other installed avionic equipment and function within their full range capabilities. Equipment installed during the test was as follows:

a. The SR-3 required turn-rate information to provide slaving cutout signals to the system during turns. A type MC-1 Rate Gyro, not furnished as part of the SR-3, was installed to fulfill this requirement.

b. The AN/ASN-50 did not include a remote magnetic transmitter as a major component of the system. This item was required to provide magnetic information necessary to operate the system in the slaved mode. A type T611/ASN Remote Magnetic Transmitter was installed to satisfy this requirement.

2.3.3.3. Mutual Interference.

2.3.3.3.1. The flux valve of the SR-3 was located in the center vertical stabilizer. The aft anticollision light on the OV-1B was the only existing power-consuming device which noticeably affected the SR-3 during calibration. Operation of the anticollision light introduced single cycle errors in excess of one degree. The system was calibrated with the light operating.

2.3.3.3.2. The flux valve of the AN/ASN-50 was located in the right wing-tip cover. The right wing-tip navigation light on the OV-1B was the only existing power-consuming device which noticeably affected the AN/ASN-50. Excessive single cycle errors were introduced when the light was operated. The system was calibrated and flight tested with the navigation lights off.

2.3.4. Analysis.

2.3.4.1. The installation of the SR-3 and the AN/ASN-50 in the OV-1B presented no unusual problems. Neither item could be installed independently of other equipment because they required inputs from other systems for proper operation.

2.3.4.2. Both the SR-3 and AN/ASN-50 are designed to operate from a three-phase, 115-volt a.c., 400-Hertz, Wye-wound primary power source. The OV-1B is equipped with this primary power source. However, the majority of the aircraft in the Army inventory are equipped with three-phase, 115-volt a.c., 400-Hertz, Delta-wound inverters. To install either system in these aircraft, it would be necessary to install a Delta-to-Wye transformer to mate the systems to the aircraft primary a.c. power source.

2.4. OPERATIONAL CHARACTERISTICS.

2.4.1. Objective.

To determine the operational characteristics of the SR-3 and AN/ASN-50 installed in an OV-1B Airplane using the MA-1 Compass System as a control factor.

2.4.2. Method.

2.4.2.1. The test items were calibrated using the MC-1 Compass Calibrator and results were recorded. The test items were operated during flight in the OV-1B Airplane. Any mutual interference occurring between the test systems and other power-consuming devices was noted.

2.4.2.2. The OV-1B Airplane was operated within the flight envelope limitations and the heading indication received from the test items was compared with that provided by the AN/ASN-62 instrumentation and the MC-1 Compass Calibrator. Operational flights included turns to heading of 15 degrees' separation, climbs, dives, steep turns, and straight and level flight. The steep turns were banks of at least 45 degrees. Turns of 90, 180, 270, 360, 450, 540, 630, and 720 degrees were accomplished in both directions.

2.4.2.3. The test items were operated in conjunction with the Doppler navigator and other installed electronic equipment requiring heading information.

2.4.2.4. The warm-up time required for the test items to become operational prior to conducting above tests was measured.

2.4.2.5. The controls were inspected and operated to evaluate the ease of identification and operation of these controls.

2.4.3. Results.

2.4.3.1. No adverse effects were noted when the test items were operated on the ground or in flight with other installed avionic equipment.

2.4.3.2. Accuracy of the systems was as follows:

2.4.3.2.1. The results of ground swing of the MA-1, SR-3, and the AN/ASN-50 are contained in part A, appendix I, section 3.

2.4.3.2.2. The average errors obtained from four air swings are contained in parts B and C, appendix I, section 3.

2.4.3.2.3. Gimbaling errors introduced by pitch changes were not detectable on either the SR-3 or AN/ASN-50; however, errors in excess of eight degrees were present on the MA-1.

2.4.3.2.4. Doppler position errors (angular error) are contained in part D, appendix I, section 3.

2.4.3.2.5. Drift rates of the test items operating in the free DG mode are contained in part E, appendix I, section 3.

2.4.3.2.6. The difference between the two most accurate outputs of the individual test items is contained in part F, appendix I, section 3.

2.4.3.3. No adverse effects were noted in the test items when the OV-1B was operated from PSP.

2.4.3.4. The time required for the MA-1, AN/ASN-50, and SR-3 to become operational (80 percent synchronous speed) after power was applied was 1.0 minute, 1.3 minutes, and 1.9 minutes, respectively.

2.4.3.5. All controls of the test items were easily identified and operated. The SR-3 and AN/ASN-50 control heads incorporated a fast synchronized mode which was a desirable feature.

2.4.4. Analysis.

With all systems operating in the magnetic or DG mode, the AN/ASN-50 performance was equal to or better than the SR-3 and the

SR-3 performance was equal to or better than the MA-1. The outputs of all systems were adequate.

2.5. MISSION SUITABILITY.

2.5.1. Objective.

To determine the compliance of the SR-3 and AN/ASN-50 with the MC's (reference 7, appendix IV, section 3).

2.5.2. Method.

The performance of the SR-3 and AN/ASN-50 was compared with that required by the proposed MC's.

2.5.3. Results.

The SR-3 and AN/ASN-50 met ten and failed to meet six of the twenty-six essential requirements of the proposed MC's. The systems only partially met one of the requirements. It will be determined during engineering tests whether the test items meet the remaining nine requirements. For a point-by-point comparison of the test items with the proposed MC's, see appendix II, section 3.

2.5.4. Analysis.

Not applicable.

2.6. SAFETY.

2.6.1. Objective.

To determine the safety characteristics of the SR-3 and AN/ASN-50.

2.6.2. Method.

2.6.2.1. The installations of the SR-3 and AN/ASN-50 in the aircraft were examined and possible safety hazards were noted.

2.6.2.2. The SR-3 and AN/ASN-50 were examined to determine whether any safety hazards existed.

2.6.3. Results.

There were no safety limitations or precautions required for the operation or use of the SR-3 or AN/ASN-50 and the proposed MC's did not contain any safety requirements. No unsafe features were found in the SR-3 and AN/ASN-50.

2.6.4. Analysis.

Not applicable.

2.7. RELIABILITY.

2.7.1. Objective.

To determine the reliability of the test items during the test period in terms of total operation time to total number of failures.

2.7.2. Method.

The total operating time during the test program and the total number of failures (compiled in paragraph 2.8) were used to arrive at a mean time between failure (MTBF).

2.7.3. Results.

	SR-3	AN/ASN-50
Total failures	2	None
Total operating time	258.5 hours	120.0 hours
MTBF	129.25 hours	N/A

2.7.4. Analysis.

The AN/ASN-50 did not fail during the test period. The failures experienced by the SR-3 were minor in nature and were easily corrected. (See paragraph 2.8.) A major redesign or modification of the equipment will not be required.

2.8. MAINTENANCE AND SUPPORT REQUIREMENTS.

2.8.1. Objective.

To determine the maintenance and support requirements of the SR-3 and AN/ASN-50.

2.8.2. Method.

2.8.2.1. The SR-3 and AN/ASN-50 were maintained and the total operating time, failures, total active maintenance down time, mean time to repair and replacement parts required were recorded.

2.8.2.2. The SR-3 and AN/ASN-50 were evaluated with respect to the ease of maintenance, packaging density, availability of check points, and suitability of calibration procedures.

2.8.2.3. The standard avionic maintenance tool kit was utilized, as practical, to evaluate its adequacy. Special tools and test equipment required for maintenance were recorded.

2.8.3. Results.

2.8.3.1. Total operating time was 258.5 hours for the SR-3 and 120.0 hours for the AN/ASN-50. No failures were encountered on the AN/ASN-50. The SR-3 experienced the following failures. The first failure occurred 2 February 1966 at 167.5 operating hours, and the second failure occurred 27 March 1966 at 232.1 operating hours.

Problem	Corrective Action	Maintenance Category	Man-Hours	Remarks
a. Intermittent operation of heading coupler resulted in inaccurate magnetic information.	1. Removed coupler from aircraft.	Organizational	0.2	Defective module was returned to manufacturer for repair. Cause of problem was isolated to
	2. Bench checked and analyzed system.	Direct Support	1.0	

Problem	Corrective Action	Maintenance Category	Man-Hours	Remarks
	3. Removed and replaced servo assembly.	Direct Support	0.1	the contact pressure between movable contact and the coil of the compensator potentiometer. The manufacturer stated that they have changed to movable contact with a higher spring tension to eliminate future problems of this nature.
	4. Final system checked.	Direct Support	0.5	
	5. Replaced coupler in aircraft and performed serviceability check.	Organizational	0.4	
		TOTAL	2.2	
b. System would not synchronize. Malfunction indicator appeared at all times. Servo response very slow.	1. System ground checked.	Organizational	0.25	Defective heading coupler was returned to manufacturer for repair. Problem was isolated to defective amplifier circuit (ARI). Repair was not accomplished on site because of lack of repair parts.
	2. Removed system from aircraft.	Organizational	0.50	
	3. Bench checked and analyzed system.	Direct Support	1.25	
	4. Substituted a heading coupler.	Direct Support	0.10	

Problem	Corrective Action	Maintenance Category	Man-Hours	Remarks
	5. Final system checked.	Direct Support	0.50	None.
	6. Replaced system and performed serviceability check.	Organizational	0.70	None.
		TOTAL	3.30	

2.8.3.2. Active maintenance time was as follows:

	SR-3	AN/ASN-50
Total scheduled maintenance time	13.8	6.4
Total unscheduled maintenance time	5.5	None

2.8.3.3. Mean time to repair $\left(\frac{\text{Total unscheduled maintenance time}}{\text{Total number of failures}}\right)$ the SR-3 was 2.75 man-hours. Repairs were not required on the AN/ASN-50.

2.8.3.4. Repairs beyond replacement of major components were not accomplished because repair parts were not provided for the test. Defective components were repaired by the manufacturer (paragraph 2.8.3.1). Parts required during the test were:

Parts Used	Nomenclature	Hours of Operation at Time of Failure	System
KE-66	Heading Coupler	162.5	SR-3
KE-66	Heading Coupler	232.1	SR-3

2.8.3.5. Normal servicing of both the SR-3 and AN/ASN-50 was accomplished without difficulty. The AN/ASN-50 provided accessible test points for verification of all of the system's primary voltage and signal sources. The SR-3 did not provide accessible test points for maintenance categories above organizational.

2.8.3.6. System calibration (compass swing) procedures of both test items were comparable; however, both were excessively time-consuming as a result of the complexity of the calibrating device (MC-1 Magnetic Compass Calibrator Set).

2.8.3.7. The TK-105/G and the TK-100/G Tool Kits were adequate for performing organizational through general-support categories of maintenance on the SR-3 and the AN/ASN-50. No special tools were required.

2.8.3.8. Special test equipment was required to perform maintenance on both systems through the general-support category. Special test equipment used and required was:

Item	Type
Magnetic Heading Simulator	Manufacturer A Part No. 2586546
Compass Calibrator	MC-2 (MC-1 modified)
System Interconnecting Cable	(Local fabrication)
Scorsby Table	Manufacturer A Part No. 2585982
Tilt Table	Manufacturer A Part No. 2586334
Phase Angle Voltmeter	Manufacturer B Part No. 202B
Servoed Repeater	Manufacturer C Part No. C054430020

Common test equipment necessary to supplement the special equipment listed above was normally found at the maintenance categories indicated and was considered adequate.

2.8.4. Analysis.

2.8.4.1. The AN/ASN-50 met the MC's pertaining to maintainability. The SR-3 did not meet the MC's because of the lack of accessible test points for higher categories of maintenance. The effort required to maintain either system was considered to be acceptable for this type of equipment.

2.8.4.2. Because of the complexity of the calibrating device (MC-1) and the degree of accuracy that was required, the calibration time (16 man-hours for each system) was excessive. A manual swing to achieve comparable accuracies would require more time and personnel.

2.8.4.3. Man-hours required to perform repair operations during the test were not considered excessive.

2.8.4.4. The two failures experienced with the SR-3 were considered to be easily correctible and presented no major problem of redesign.

2.8.4.5. The manufacturer of the AN/ASN-50 has ten available pieces of special ground-support equipment (one for flight line and nine for intermediate level) designed to simplify maintenance operations. The equipment was not available during the test. However, if the Army procures the AN/ASN-50, this equipment should be evaluated to determine its need and adequacy.

SECTION 3 - APPENDICES

APPENDIX I

TEST DATA

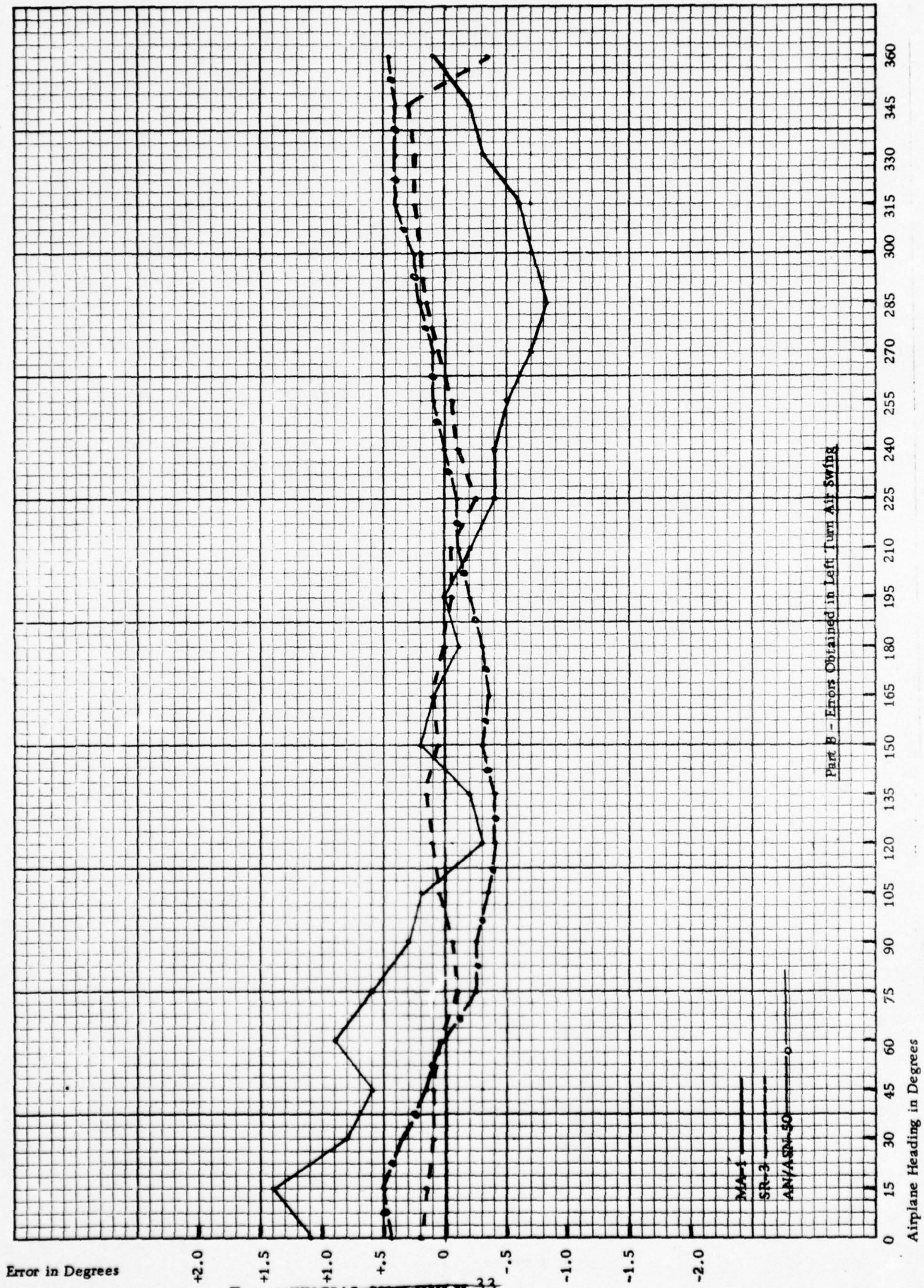
		Page No.
Part A	Ground Swing	31
Part B	Errors in Left Turn Air Swing	33
Part C	Errors in Right Turn Air Swing	35
Part D	Doppler Position Errors	37
Part E	Drift Rates	39
Part F	Errors Between Outputs	41

Part A

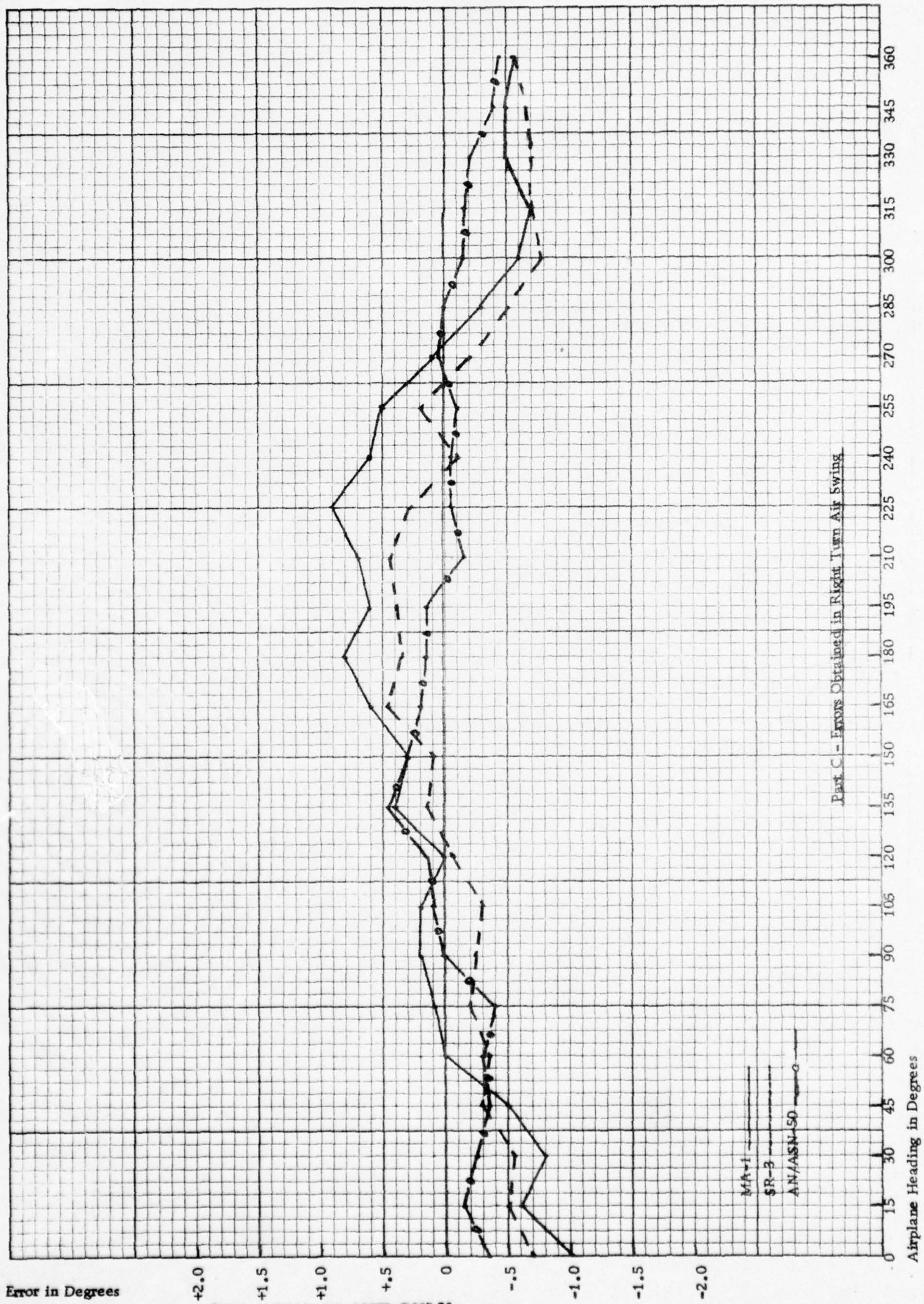
Ground Swing of the MA-1, SR-3, and AN/ASN-50

Actual Heading	MA-1	SR-3	AN/ASN-50
00	00° 00'	359° 58'	359° 57'
15	15° 02'	15° 09'	15° 06'
30	29° 56'	29° 58'	30° 06'
45	45° 04'	44° 56'	45° 03'
60	60° 04'	59° 59'	60° 04'
75	75° 07'	75° 00'	75° 02'
90	89° 54'	90° 04'	90° 04'
105	104° 58'	104° 03'	105° 05'
120	119° 59'	120° 03'	120° 00'
135	135° 04'	135° 00'	134° 55'
150	150° 06'	150° 06'	149° 56'
165	165° 05'	165° 01'	165° 01'
180	180° 09'	180° 02'	180° 03'
195	194° 57'	194° 52'	195° 05'
210	209° 59'	210° 09'	210° 06'
225	225° 05'	224° 57'	225° 02'
240	239° 57'	239° 55'	240° 05'
255	255° 06'	254° 56'	255° 04'
270	270° 04'	269° 58'	270° 01'

Actual Heading	MA-1	SR-3	AN/ASN-50
285	285° 05'	284° 56'	284° 59'
300	300° 03'	299° 56'	300° 01'
315	314° 59'	314° 53'	314° 57'
330	330° 02'	329° 52'	330° 04'
345	345° 06'	344° 58'	345° 06'



Part B - Errors Obtained in Left Turn Air Swing



Part C - Errors Obtained in Right Turn Air Swing

Part D

Doppler Position Errors

From - To	Distance (km.)	Track (degrees)	Angular Error (degrees) MA-1	AN/ASN-50	SR-3
Cairns--Crestview	103.3	240.6	0.1R	0.1R	0.7L
			0.4L	0.3R	0.8L
			0.1R	0.8L	0.2L
Crestview--Eglin	49.8	164.2	2.4R	0.1L	1.2L
			0.6R	0.2R	0.5L
			0.3R	0.1L	0.9L
Eglin--Tyndall*	114.6	114.1	1.7R	1.6L	0.4R
			1.2R	0.7L	2.1R
			1.0R	1.7L	0.1R
Tyndall--Perry Foley**	180.5	86.7	1.5R	1.1L	0.5L
			2.2R	1.0L	0.5L
			0.8R	1.3L	0.1L
Perry Foley--Tallahassee	70.2	313.4	1.0L	0.0	0.0
			0.9L	0.5L	0.7R
			0.7L	0.7L	0.1R
Tallahassee--Albany	124.2	354.5	2.1L	0.0	0.1L
			1.2L	0.1R	0.9L
			1.8L	0.4L	0.2L
Albany--Eufaula	92.3	293.6	0.9L	0.7R	0.3R
			0.4L	0.6R	0.4L
			0.9L	0.7R	0.2R
Eufaula--Marianna	129.1	179.7	1.7L	0.1L	0.5L
			1.0L	0.2R	0.0
			0.1L	0.3L	0.8L
Marianna--Cairns	78.6	313.0	0.2R	0.2R	0.3L
			0.1L	0.2R	0.4R
			0.5L	0.4R	0.4R

*Over-water flight

**Partly over-water flight

From - To	Distance (km.)	Track (degrees)	Angular Error (degrees) MA-1	AN/ASN-50	SR-3
Cairns--Marianna	78.6	133.0	2.4L	0.2R	0.0
			1.2R	0.6L	0.1R
			0.3L	0.4L	0.4L
Marianna--Eufaula	129.1	359.7	1.2L	0.1R	0.1R
			0.2L	0.5L	0.1R
			0.3L	0.1L	0.8R
Eufaula--Albany	92.3	113.6	0.9R	0.2R	0.3L
			0.5R	0.4L	0.3L
			0.2R	0.4R	0.6R
Albany--Tallahassee	124.2	174.5	2.8R	0.2L	0.6L
			0.0	0.1L	0.8L
			0.3L	0.3L	0.8L
Tallahassee--Perry Foley	70.2	133.4	1.6R	0.5L	1.3L
			0.2R	0.1L	1.3L
			0.2L	0.3L	1.1L
Perry Foley--Tyndall*	180.5	266.7	0.1L	0.6R	0.9L
			1.5L	0.0	1.0L
			0.3L	0.1L	0.5L
Tyndall--Eglin**	114.6	294.1	0.4L	0.0	0.1L
			1.4L	1.6L	0.6L
			0.3L	1.0L	0.8L
Eglin--Crestview	49.8	344.2	0.4L	0.3R	0.4L
			0.7R	0.3L	0.4L
			***	1.3L	0.2L
Crestview--Cairns	103.3	61.6	1.5L	0.2L	0.6R
			0.7R	0.0	1.4L
			***	0.2R	0.0
		Total Error	45.4	24.0	28.8
		Average Error	0.892	0.444	0.533

*Over-water flight
**Partly over-water flight
***Data not reliable

Part E

Drift Rates

Flight No. 1

Time (minutes)	Maximum Drift Allowed (degrees)	MA-1 Drift	MA-1 Rate (degrees/hour)	SR-3 Drift	SR-3 Rate (degrees/hour)	AN/ASN-50 Drift	AN/ASN-50 Rate (degrees/hour)
0 - 24	0.43	-0.9	2.25*	+0.2	0.50	-0.2	0.50
24 - 58	0.57	-0.2	0.35	+0.6	1.06*	-0.2	0.35
58 - 77	0.34	0.0	-	0.0	-	-0.2	0.63
77 - 99	0.37	0.0	-	-0.2	0.55	0.0	-
99 - 117	0.30	-0.4	1.33*	-0.2	0.67	-0.2	0.67
117 - 177	1.00	-1.5	1.50*	-1.5	1.50*	-0.4	0.40
177 - 230	0.88	-1.1	1.25*	+0.1	0.11	-0.6	0.68

Flight No. 2

Time (minutes)	Maximum Drift Allowed (degrees)	MA-1 Drift	MA-1 Rate (degrees/hour)	SR-3 Drift	SR-3 Rate (degrees/hour)	AN/ASN-50 Drift	AN/ASN-50 Rate (degrees/hour)
0 - 26	0.43	+5.1	11.78*	+0.3	0.69	+0.2	0.46
26 - 42	0.27	+2.9	10.89*	0.0	-	-0.1	0.37
42 - 64	0.37	+3.8	10.36*	-0.2	0.54	0.0	-
64 - 87	0.38	+2.2	5.74*	-0.1	0.26	-0.1	0.26
87 - 108	0.35	+2.0	5.57*	-0.3	0.86	0.0	-
108 - 124	0.27	+2.8	10.50*	-0.1	0.38	0.0	-
124 - 205	1.35	+4.9	3.63*	-0.3	0.22	-0.8	0.59

*Exceeds limits of 0.1°/hour

Part F

Errors Between Outputs

	MA-1			SR-3			AN/ASN-50		
Heading	CX (Doppler)	CX (Photo)	Error	CX (Doppler)	CX (Photo)	Error	CX (Doppler)	CX (Photo)	Error
0	0.00	0.00	-	359.97	359.94	-0.03	359.95	359.93	-0.02
15	15.03	15.20	+0.17	15.15	15.12	-0.03	15.10	15.00	-0.10
30	29.93	30.05	+0.12	29.97	29.94	-0.03	30.10	29.98	-0.12
45	45.07	45.13	+0.06	44.93	44.91	-0.02	45.05	44.92	-0.13
60	60.07	60.20	+0.13	59.98	59.93	-0.05	60.07	60.04	-0.03
75	75.11	75.15	+0.04	75.00	69.90	-0.10	75.03	75.01	-0.02
90	89.90	89.95	+0.05	90.07	69.97	-0.10	90.07	90.02	-0.05
105	104.97	104.90	-0.07	105.05	104.95	-0.10	105.08	105.11	+0.03
120	119.98	120.00	+0.02	120.05	119.93	-0.12	120.00	119.98	-0.02
135	135.07	135.03	-0.04	135.00	134.88	-0.12	134.92	134.89	-0.03
150	150.10	149.95	-0.15	150.10	149.98	-0.12	149.93	149.86	-0.07
165	165.08	164.95	-0.13	165.02	164.92	-0.10	165.02	164.99	-0.03
180	180.15	180.10	-0.05	180.03	179.98	-0.05	180.05	179.95	-0.10
195	194.95	195.00	+0.05	194.87	194.87	-	195.08	194.95	-0.13
210	209.98	210.00	+0.02	210.15	210.18	+0.03	210.10	209.95	-0.15
225	225.08	225.05	-0.03	224.95	224.98	+0.03	225.03	224.91	-0.12

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	MA-1			SR-3			AN/ASN-50		
Heading	CX (Doppler)	CX (Photo)	Error	CX (Doppler)	CX (Photo)	Error	CX (Doppler)	CX (Photo)	Error
240	239.95	240.03	+0.08	239.92	239.94	+0.02	240.08	240.01	-0.07
255	255.10	255.10	-	254.93	254.95	+0.02	255.07	255.05	-0.02
270	270.06	270.05	-0.01	269.97	269.99	+0.02	270.02	270.00	-0.02
285	285.08	284.95	-0.13	284.93	284.96	+0.03	284.98	285.00	+0.02
300	300.05	299.95	-0.10	299.90	299.95	+0.05	300.02	300.00	-0.02
315	314.99	314.85	-0.14	314.88	314.86	-0.02	314.95	314.92	-0.03
330	330.07	329.85	-0.22	329.87	329.85	-0.02	330.07	330.07	-
345	345.10	344.95	-0.15	344.97	344.92	-0.05	345.10	345.15	+0.05

APPENDIX II

FINDINGS

The following is a point-by-point comparison of the SR-3 and AN/ASN-50 with the proposed MC's (reference 7, appendix IV, section 3).

Requirement	Test Item Meets Requirement: SR-3	Test Item Meets Requirement: AN/ASN-50	Remarks
* * * * *			
II. Operational Characteristics.			
1. General: The UHRS shall provide a magnetically slaved or unslaved gyro stabilized heading reference for Army aircraft. The equipment shall provide the required heading information for one pilot and one copilot heading display and, if required, provide a minimum of three isolated outputs for other electronic equipment.	Yes	Yes	
2. Accuracy: The nominal heading accuracy of the system shall be as follows:			
a. Slaved operation $\pm 0.4^{o}$.	No	No	The slaved accuracy of the SR-3 averaged 0.533 degree and the slaved accuracy of the AN/ASN-50 averaged 0.444 degree.

Requirement	Test Item Meets Requirement SR-3	Test Item Meets Requirement AN/ASN-50	Remarks
b. Free gyro operation 1.0°/Hr.	No	Yes	Fourteen checks of drift rate were performed. The SR-3 exceeded the 1.0°/Hr. on two occasions.
3. Special Features: Provisions shall be made to facilitate various system configurations through the utilizations of plug-in modules. By virtue of the universal selective component concept, the system configuration of the AN/ASN-43(V) shall be variable to the extent required to meet the light weight, low volume demands of the less sophisticated aircraft and the more complex maximum system configuration necessary to satisfy the more stringent requirements of the all weather, navigation mission of the larger, sophisticated aircraft systems.	No	No	Neither the SR-3 nor AN/ASN-50 was designed to facilitate various system configurations by use of plug-in modules.
III. Physical Characteristics.			
1. Limiting Weight and Volume Factors:			

Requirement	Test Item Meets Requirement SR-3	Test Item Meets Requirement AN/ASN-50	Remarks
a. The weight of the universal heading reference system shall not exceed 25 lbs. when all plug-in components are utilized.	Yes	No	Weight of the AN/ASN-50 exceeded the requirement by 24.69 pounds.
b. Volume shall not exceed .6 cubic ft. when all plug-in components are utilized.	Yes	No	Volume of the AN/ASN-50 exceeded the requirement by 0.232 cubic foot.
c. Weight is minimized through the utilization of plug-in modules, by using only those components specifically required for a particular aircraft installation.	No	No	Neither system was designed to meet the universal heading reference concept. If any module was removed, the system would fail to operate within its full capability.
2. Arrangement and Coordination of Component Units: Components shall be capable of being readily mounted or dismounted for use, servicing, transport, or replacement, and shall be compatible with all instrument groups or systems requiring heading information.	Yes	Yes	

Requirement	Test Item Meets Requirement SR-3	AN/ASN-50	Remarks
3. Provision for Equipment to Operate in Conjunction with Other Electronic and Intended Associated Equipment: Design of the equipment shall permit installation independent of other installed electronic equipment.	No	No	
Furthermore, it shall be compatible with stabilization, navigation, and surveillance systems requiring heading information.	Yes	Yes	
4. Anticipated Power Supply Considerations: The equipment shall be capable of operation with a primary source of power from the aircraft electrical system without interference to other power consuming devices in the aircraft. The equipment shall require minimum power.	Yes	Yes	
5. Adaptability to Alteration: Maximum practicable use shall be made of MIL standard type components in the design and construction of this equipment. However, other improved components	Yes	Yes	

Requirement	Test Item Meets Requirement SR-3	AN/ASN-50	Remarks
and techniques which will enhance the design of the equipment should be considered.			
6. Construction and Special Requirements to Meet Operation, Transportation, Packaging, and Storage Conditions:			
a. Vibration: The equipment shall meet the shock tests of MIL-T-5422 par 4. 3. 2. 1.	Unknown	Unknown	To be determined by engineering tests.
b. Shock: The equipment shall meet the shock tests of MIL-T-5422 par 4. 3. 2. 1.	Unknown	Unknown	To be determined by engineering tests.
c. Humidity: The equipment shall meet the humidity environment of MIL-T-5422 par 4. 4. 2.	Unknown	Unknown	To be determined by engineering tests.
d. Temperature-Altitude: The equipment shall meet the temperature-altitude requirements of MIL-T-5422 par 4. 1. 2.	Unknown	Unknown	To be determined by engineering tests.
e. Salt Spray: The equipment shall meet the salt spray requirements of MIL-T-5422 par 4. 5.	Unknown	Unknown	To be determined by engineering tests.

Requirement	Test Item Meets Requirement SR-3	Test Item Meets Requirement AN/ASN-50	Remarks
f. Explosion: The equipment shall meet the explosion requirements of MIL-T-5422 par 4.6.	Unknown	Unknown	To be determined by engineering tests.
g. Sand and Dust: The equipment shall meet the sand and dust environment of MIL-T-5422 par 4.7.	Unknown	Unknown	To be determined by engineering tests.
h. Fungus: The equipment shall meet the fungus environment of MIL-T-5422 par 4.8.	Unknown	Unknown	To be determined by engineering tests.
i. RFI: The equipment shall meet the requirements of the susceptibility and interference tests of MIL-I-26600 (USAF) for Class I equipment.	Unknown	Unknown	To be determined by engineering tests.
IV. Equipment Operation and Maintenance Characteristics.			
1. Operating Time: Equipment shall be capable of continuous reliable operation for a period of 23 hours during each 24-hour period without requiring adjustment, calibrating or maintenance.	Yes	Yes	

Requirement	Test Item Meets Requirement SR-3	AN/ASN-50	Remarks
2. Maximum Acceptable Preparation Period from Secured or Power-Off Conditions: Equipment shall be capable of satisfactory operation within 2 minutes after power has been applied.	Yes	Yes	
3. Personnel Considerations: Controls shall be capable of being easily identified and adjusted by Army aviators in flight. Organizational maintenance shall be carried out through readily accessible check points and unit replacement on the "Go-no-Go" basis.	Yes	Yes	
4. Provisions for Field Maintenance.			
a. Design of equipment shall facilitate field maintenance by providing readily accessible test points and jacks, and providing for easy replacement of component units.	No	Yes	SR-3 did not have readily accessible test points.
b. Equipment shall be designed to require a minimum of tools and test equipment. Whenever possible, the required	Yes	Yes	

Requirement	Test Item Meets Requirement SR-3	AN/ASN-50	Remarks
tool and test equipment shall be of the type currently for issue in the field Army.			
c. Special tools, test equipment, maintenance manuals, and parts lists, if required, shall be furnished with the prototype models.	No	No	Tools, test equipment, manuals, and parts lists were not provided for a military potential test.

APPENDIX III

DEFICIENCIES AND SHORTCOMINGS

1. Deficiencies. No deficiencies were noted on either flight reference system.

2. Shortcomings. The following shortcomings were noted during this test:

Shortcoming	Suggested Corrective Action	Remarks
SR-3		
a. The KE-66 Heading Coupler experienced two random failures during the test period.	None.	
b. Test points were not readily accessible for categories of maintenance above organizational maintenance.	Provide accessible test points.	
c. Drift rate (DG mode) was excessive.	None.	
AN/ASN-50		
Weight of the AN/ASN-50 exceeded the MC requirement.	None.	

APPENDIX IV

REFERENCES

1. Human Factors Engineering Manual, published by Dunlap and Associates, Inc., 429 Atlantic Street, Stanford, Connecticut, 1961.

2. "Preliminary Engineering Report, Universal Gyromagnetic Compass Set, AN/ASN-43(V)," US Army Signal Research and Development Laboratory, 1 April 1962.

3. "Final Project Review and Value Analysis of Gyromagnetic Compass Set, AN/ASN-43(V)," US Army Signal Research and Development Laboratory, 13 August 1962.

4. "Environmental Test Report, Universal Gyromagnetic Compass Set, AN/ASN-43(V)," USASSA, Fort Monmouth Contract No. DA 36-039-SC-90865, February 1963.

5. "Final Report, Universal Gyromagnetic Compass Set, AN/ASN-43," US Army Electronic Proving Ground, February 1963.

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9. Plan of Test, USATECOM Project No. 4-4-4338-01, "Confirmatory Test of Compass Controller C-6343/ASN," US Army Aviation Test Board, 8 June 1964.

10. Combat Developments Objectives Guide, Paragraph No.'s 533c(5) and (6), 15 August 1964, with revisions.

11. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 29 September 1964, subject: "Planning Directive, USATECOM Project No. 4-3-3015-01, -02, Test Planning, AN/ASN-62( ) Gyromagnetic Compass Set."

12. Coordinated Test Program, AN/ASN-62, Gyromagnetic Compass Set, US Army Test and Evaluation Command, November 1964.

13. Plan of Test, USATECOM Project No. 4-5-3015-03, "Service Test Plan of Test of AN/ASN-62( ), Gyromagnetic Compass Set," US Army Aviation Test Board, 29 January 1965.

14. Message, SMOSM-NSPA-9-04-5802, Commanding General, US Army Aviation Materiel Command, 11 April 1965, subject: "CH34C Acft for Map."

15. Plan of Test, USATECOM Project No. 4-6-3260-01, "Military Potential Test of the SR-3 Miniature Flight Reference System," US Army Aviation Test Board, 5 November 1965.

16. Final Report of Test, USATECOM Project No. 4-5-3015-03, "Service Test of the AN/ASN-62( ) Gyromagnetic Compass Set," US Army Aviation Test Board, 28 February 1966.

APPENDIX V

DISTRIBUTION

USATECOM Project No.'s 4-6-3260-01 and 4-6-3261-01

Agency	Final Report
Commanding General US Army Test and Evaluation Command ATTN: AMSTE-BG Aberdeen Proving Ground, Maryland 21005	2
Commanding General US Army Electronics Command ATTN: AMSEL-VL-N Fort Monmouth, New Jersey 07703	25

CODE SHEET

This code sheet will not be distributed outside the Department of Defense.

SR-3	General Electric Instrument Division
AN/ASN-50	Lear Siegler, Inc.
Manufacturer A	Sperry Phoenix Company, Division of Sperry Rand Corporation
Manufacturer B	North Atlantic Industries, Inc.
Manufacturer C	Kearfott Division of General Precision, Inc.

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Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
US Army Aviation Test Board Fort Rucker, Alabama 36360	Unclassified ([redacted]) 2b. GROUP

3. REPORT TITLE

MILITARY POTENTIAL TEST OF THE SR-3 AND AN/ASN-50 FLIGHT REFERENCE SYSTEMS (U)

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report of Test, 26 November 1965 to 30 April 1966

5. AUTHOR(S) *(Last name, first name, initial)*

Wroten, Cecil E., Major, SIGC

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
May 1966	61	16

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. None	USATECOM Project Numbers 4-6-3260-01 and 4-6-3261-01
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	None

10. AVAILABILITY/LIMITATION NOTICES

[redacted]

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Protective markings have been placed on the report because the report is of a sensitive nature from the manufacturers' and test agency's standpoint.	Commanding General US Army Electronics Command Fort Monmouth, New Jersey 07703

13. ABSTRACT

The US Army Aviation Test Board conducted the military potential test of the SR-3 and AN/ASN-50 Flight Reference Systems at Fort Rucker, Alabama. The SR-3 and AN/ASN-50 were flight tested in an OV-1B for 258.5 hours and 120.0 hours during the period 26 November 1965 to 18 April 1966 and 1 February 1966 to 30 April 1966, respectively. The systems were compared with the requirements of the proposed Military Characteristics (MC's). Both systems met ten of the twenty-six essential requirements, failed to meet six, and only partially met one of the requirements. It will be determined during engineering tests whether the systems meet the remaining nine essential requirements. It was concluded that both systems have military potential and that correction of the shortcomings would enhance the potential of each. It was recommended that both systems be subjected to engineering/service tests and that the shortcomings be corrected if technically and economically feasible. (U) (FOR OFFICIAL USE ONLY)

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14. KEY WORDS		LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Military Potential Test	Installation requirements						
SR-3 Flight Reference System	Maintenance requirements						
AN/ASN-50 Flight Reference System	Support requirements						
OV-1B Airplane	Deficiencies						
Proposed Military Characteristics	Shortcomings						
Size							
Operational characteristics							
Weight							
Accuracy							
Doppler navigator							
Mission suitability							
Safety							
Reliability							

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